

REMARKS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-22 are currently pending, with Claims 17-22 withdrawn as directed to a non-elected invention. No claims have been amended herewith.

In the outstanding Office Action, Claims 1, 2, 5, and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,510,630 to Agarwal et al. (hereinafter “the ‘630 patent”) in view of U.S. Patent No. 6,242,784 to Zeng et al. (hereinafter “the ‘784 patent”); Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘630 and ‘784 patents, further in view of U.S. Patent No. 6,184,556 to Yamazaki et al. (hereinafter “the ‘556 patent”); and Claims 6-10 and 12-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘630 and ‘784 patents, further in view of Hu et al. (“Hot-Electron-Induced MOSFET Degradation—Model, Monitor, and Improvement”) (hereinafter “the Hu reference”).

Applicants wish to thank the Examiner for the interview granted Applicants’ representative on February 11, 2004, at which time the patentability of Claim 1 was discussed with respect to the ‘630 and ‘784 patents. At the conclusion of the interview, the Examiner agreed that the ‘630 and ‘784 patents fail to disclose the step of calculating a volume integral, as recited in Claim 1.

Claim 1 is directed to a method of manufacturing a semiconductor device, comprising: (1) forming a semiconductor element in a semiconductor active region, the semiconductor active region being in an electrically floating state, and calculating a generation rate of electron hole pairs caused by impact ionization in the semiconductor element; (2) *calculating a volume integral of the generation rate of electron hole pairs in an area where the impact ionization is caused*; (3) evaluating time-dependent variations of

electrical characteristics of the semiconductor element on the basis of the volume integral; and (4) manufacturing a semiconductor device based on results of the evaluating step.

Regarding the rejection of Claim 1 under 35 U.S.C. § 103, the Office Action asserts that the '630 patent discloses everything in Claim 1 with the exception of calculating the generation rate of electron hole pairs caused by impact ionization, and relies on the '784 patent to remedy that deficiency.

The '630 patent is directed to a non-volatile random access memory cell constructed of silicon carbide. As shown in Figure 2A, the '630 patent discloses p and p+ layers 18 and 20, that function as either well regions or isolation regions. Moreover, the '630 patent discloses that the lower the generation rate of electron hole pairs, the smaller the leakage current value. However, as admitted in the Office Action, the '630 patent fails to disclose calculating the generation rate of electron hole pairs caused by impact ionization, as recited in Claim 1. Moreover, Applicants submit that the '630 patent fails to disclose *calculating the volume integral of the generation rate of electron hole pairs in an area where the impact ionization is caused*. Accordingly, it follows that the '630 patent also fails to disclose the steps of (1) evaluating time-dependent variations of electrical characteristics on the basis of the volume integral, and (2) manufacturing a semiconductor device based on the results of the evaluating step.

The '784 patent is directed to a process for forming a silicon die having improved edge termination. The '784 patent discloses that the withstand pressure of a semiconductor element is evaluated based on the position where impact ionization is extensively performed and the maximum rate of impact ionization. However, Applicants submit that the '784 patent fails to disclose *calculating a volume integral of the generation rate of electron hole pairs in an area where the impact ionization is caused*, as recited in Claim 1. Accordingly, it follows that the '784 patent also fails to disclose the steps of (1) evaluating time-dependent variations

of electrical characteristics based on the volume integral, and (2) manufacturing a semiconductor device based on the results of the evaluating step.

Thus, no matter how the teachings of the '630 and '784 patents are combined, the combination does not teach or suggest (1) calculating the *volume integral* of the generation rate of electron hole pairs in an area where the impact ionization is caused; and (2) evaluating time-dependent variations of electrical characteristics of the semiconductor element on the basis of the *volume integral*, as recited in Claim 1. Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of Claim 1 (and dependent Claims 2 and 5) should be withdrawn.

Claim 11 recites limitations analogous to the limitations recited in Claim 1. Accordingly, for the reasons stated above for the patentability of Claim 1, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of Claim 11 should be withdrawn.

Regarding the rejection of Claim 3 under 35 U.S.C. § 103, Applicants respectfully submit that the '556 patent fails to remedy the above-noted deficiencies of the '630 and '784 patents. Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of dependent Claim 3 should be withdrawn.

Claim 12 is directed to a method of manufacturing a semiconductor device, comprising, *inter alia*: (1) forming a first insulated gate field effect transistor having a body contact electrode and a first semiconductive active region; (2) forming a second insulated gate field effect transistor without a body contact electrode in a second semiconductor active region, the second semiconductor active region being in an electrically floating state, on said insulated film layer, and calculating the generation rate of electron hole pairs caused by impact ionization in the second insulated gate field effect transistor; (3) *calculating a volume integral of the generation rate of the electron hole pairs and a region where impact*

ionization is caused; (4) calculating time-dependent variations of electrical characteristics of the second insulated gate field effect transistor on the basis of the volume integral; and (5) manufacturing a semiconductor device on the basis of the calculated time-dependent variations of electrical characteristics.

Regarding the rejection of Claim 12 under 35 U.S.C. § 103(a) as unpatentable over the '630 patent, the '784 patent, and the Hu reference, Applicants respectfully submit that the Hu reference fails to remedy the above-noted deficiencies of the '630 and '784 patents. In particular, the Hu reference, which describes time-dependent variations of electrical characteristics of a semiconductor element whose substrate current can be measured, fails to disclose (1) *calculating a volume integral of the generation rate of electron hole pairs in a region where impact ionization is caused*, and (2) calculating time-dependent variations of electrical characteristics of a second insulated gate field effect transistor on the basis of the volume integral. Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of Claim 12 should be withdrawn.

Claims 13 and 14 recite limitations analogous to the limitations recited in Claim 12. Accordingly, for the reasons stated above for the patentability of Claim 12, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of Claim 13 and Claim 14 (and dependent Claims 15 and 16) should be withdrawn.

Regarding the rejections of dependent Claims 6-10 under 35 U.S.C. § 103, Applicants respectfully submit that the Hu reference fails to remedy the above-noted deficiencies of the '630 and '784 patents. Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been established and that the rejection of dependent Claims 6-10 should be withdrawn.

Thus, it is respectfully submitted that independent Claims 1, 11, 12, 13, and 14 (and all associated dependent claims) patentably define over any proper combination of the '630 patent, the '784 patent, the '556 patent, and the Hu reference.

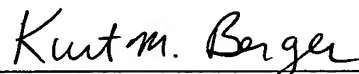
Consequently, in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The present application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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